

# Claims

- [c1] A method to communicate hydraulically with a portion of a wellbore located below a well valve, the method comprising:
- positioning and setting a bore receptacle in the wellbore below the well valve;
  - deploying a hydraulic conduit into the wellbore, the hydraulic conduit including a stinger at a distal end, the stinger configured to be inserted into the bore receptacle;
  - the hydraulic conduit further including an extraction device, the extraction device configured to retract the stinger by an extraction stroke when activated;
  - the extraction stroke being no less than the distance between the well valve and the bore receptacle.
- [c2] The method of claim 1 wherein the stinger further includes an elastomeric seal on its distal end to sealingly engage the bore receptacle.
- [c3] The method of claim 1 further comprising connecting the extraction device to hydraulic lines controlling the operation of the well valve.

- [c4] The method of claim 3 wherein hydraulic pressure of the extraction device is released prior to hydraulic pressure of the well valve, thereby retracting the stinger from the bore receptacle before the well valve is closed.
- [c5] The method of claim 1 wherein the extraction device is activated by a reduction of hydraulic pressure.
- [c6] The method of claim 1 wherein the extraction device is activated by an increase of hydraulic pressure.
- [c7] The method of claim 1 wherein the extraction device is located above a wellhead.
- [c8] The method of claim 1 wherein the extraction device is located below a wellhead.
- [c9] The method of claim 8 further comprising deploying a second hydraulic conduit, the second hydraulic conduit configured to hydraulically operate the extraction device.
- [c10] The method of claim 1 further comprising hanging a secondary conduit from the bore receptacle, wherein the secondary conduit is sealingly engaged with the hydraulic conduit when the stinger is engaged within the bore receptacle.
- [c11] The method of claim 10 further wherein the secondary conduit includes a valve along its length.

- [c12] The method of claim 11 wherein the valve is a check valve and is located at a distal end of the secondary conduit, the check valve configured to prevent fluids from the wellbore from entering the secondary conduit.
- [c13] The method of claim 11 wherein the valve is a gas lift valve.
- [c14] The method of claim 1 wherein the deploying of hydraulic conduit is performed through production tubing.
- [c15] The method of claim 1 further comprising increasing a hydraulic pressure on the extraction device to pass the hydraulic conduit through the well valve.
- [c16] The method of claim 1 further comprising retracting the stinger with the extraction device in stages.
- [c17] The method of claim 1 wherein the hydraulic conduit extending the well valve is used as a production conduit for fluids produced from the well.
- [c18] The method of claim 1 wherein the well valve is a safety valve.
- [c19] The method of claim 18 wherein the safety valve is configured to close in the event of a loss of pressure.
- [c20] The method of claim 1 further comprising

extracting the hydraulic conduit from the well valve  
when the well valve is in an open state;  
closing the well valve;  
bleeding well pressure from the wellbore; and  
monitoring the integrity of the well valve.

[c21] The method of claim 20 comprising injecting fluids down the hydraulic conduit and out its distal end above the closed well valve.

[c22] The method of claim 20 further comprising producing fluids from a well via the hydraulic conduit when the stinger is positioned above the closed well valve.

[c23] The method of claim 1 further comprising:  
opening a well valve;  
inserting the hydraulic conduit connected to the extraction device through the well valve until the stinger of the hydraulic conduit seats in the bore receptacle; and  
pumping fluid to the internal diameter of the hydraulic conduit.

[c24] The method of claim 23 further comprising hanging a secondary conduit from the bore receptacle, wherein the secondary conduit is sealingly engaged with the hydraulic conduit when the stinger is engaged within the

bore receptacle.

[c25] The method of claim 24 further comprising pumping fluids from the hydraulic conduit, through the bore receptacle, through the secondary conduit, and into the wellbore.

[c26] The method of claim 24 further comprising the production of well fluids from the wellbore, through the secondary conduit, the bore receptacle, and through the hydraulic conduit.

[c27] A method to determine the length of continuous hydraulic conduit needed for a given well, the method comprising:

- closing a well valve;
- disposing the continuous hydraulic conduit into a well until the hydraulic conduit contacts the closed valve;
- marking a position on the continuous hydraulic conduit noting the exact length of the hydraulic conduit required to reach the closed valve; and
- extracting this length of hydraulic conduit from the well.

[c28] A method to adjust a length of continuous hydraulic conduit in a well bore, the method comprising:

attaching the length of continuous hydraulic conduit in an extraction device having an inner surface and a hydraulically sealed piston through which the continuous hydraulic conduit is fixed; and  
adjusting the hydraulic pressure on either side of the extraction device to move the piston and thereby move the continuous hydraulic conduit in and out of a well valve.

- [c29] A method to move a continuous hydraulic conduit in a well, the method comprising:
- attaching the continuous hydraulic conduit to a piston retained within a cylinder, the cylinder providing a bore to permit relative longitudinal movement of the piston and hydraulic conduit connected thereto;
  - a spring to oppose the movement of the piston in the direction of the distal side;
  - applying hydraulic pressure to the piston within the cylinder to compress the spring and store potential energy therein;
  - maintaining the hydraulic pressure against the piston to maintain the spring in compression; and
  - releasing the hydraulic pressure on the piston to permit the compressed spring to move the piston and attached hydraulic conduit in the cylinder.

[c30] An apparatus to manipulate a continuous hydraulic conduit in a producing well, the apparatus comprising:

an extraction device providing a cylinder and a piston, said piston slideably engaged within said cylinder and attached to a first hydraulic conduit;

a tubing hanger assembly located below said extraction device, the hanger assembly providing a second hydraulic conduit extending therefrom;

a stinger connected to a distal end of said first hydraulic conduit, the stinger providing a sealing profile to engage a bore receptacle of the tubing hanger assembly;

the bore receptacle configured to hydraulically connect said first continuous hydraulic conduit to a second continuous hydraulic conduit; and

said extraction device configured to retract said stinger from said bore receptacle and separate said first hydraulic conduit from said second hydraulic conduit when said piston is displaced from a distal position to a proximal position within said cylinder.

[c31] The apparatus of claim 30 wherein the tubing hanger is located below a well valve and the extraction device is located above said well valve.

[c32] The apparatus of claim 31 wherein said stinger is fabricated from a frangible material to facilitate closing of the

well valve.

- [c33] The apparatus of claim 32 wherein said frangible material is glass.
- [c34] The apparatus of claim 32 wherein said frangible material is ceramic.
- [c35] The apparatus of claim 32 wherein said frangible material is sapphire.
- [c36] The apparatus of claim 31 wherein the extraction device is located above a wellhead.
- [c37] The apparatus of claim 30 further comprising a hydraulic control system to deliver hydraulic pressure to said piston of said extraction device.
- [c38] The apparatus of claim 37 wherein said hydraulic control system also activates a well valve.
- [c39] The apparatus of claim 30 wherein the cylinder is at least as long as the distance between said tubing hanger assembly and a well valve.
- [c40] The apparatus of claim 30 further comprising a check valve at a distal end of said stinger to prevent well fluids from entering said first hydraulic conduit.
- [c41] The apparatus of claim 30 further comprising a check



valve to prevent well fluids from entering said second hydraulic conduit.

[c42] The apparatus of claim 30 wherein said stinger includes an elastomeric seal, said elastomeric seal capable of sealing with said bore receptacle to isolate said first and said second hydraulic conduits from well fluids.

[c43] The apparatus of claim 30 wherein said extraction device is configured to retract when hydraulic pressure supplied thereto is reduced.

[c44] A tubing hanger comprising:  
a landing tool having  
an enlarged upper throat;  
a longitudinally spaced seal bore;  
said seal bore configured to accept a stinger connected to a distal end of a continuous hydraulic conduit;  
said stinger providing a hydraulic port communicating from its interior to its lateral exterior face, said stinger further providing a groove for matching a latching piston and providing dynamic seals for sealingly engaging an interior surface of the seal bore;  
a first hydraulic port on the interior surface of the landing tool communicating with said continuous hydraulic conduit;

a latching piston, activated by hydraulic pressure from said first hydraulic port, said first hydraulic port configured to engage a lateral surface on said stinger;

a second hydraulic port on the interior surface of the landing tool, said second port configured to communicate with the continuous hydraulic conduit and to engage a plurality of slips; and

a tubing retainer to support a second length of continuous hydraulic conduit in a well bore configured to allow continuous fluid communication from the surface through the distal end of the first continuous hydraulic conduit to the distal end of said second continuous hydraulic conduit.

[c45] An apparatus to manipulate a continuous hydraulic conduit in a well bore, the apparatus comprising:

a cylinder having a bore and providing sealed connections on each end thereby allowing movement of a continuous hydraulic conduit therethrough;

a piston providing attachment to the continuous hydraulic conduit slideably and sealingly engaging said bore of said cylinder;

a resilient member compressively engaged between an interior end of said cylinder and an exterior end of said piston;

a hydraulic pathway into said bore of the cylinder permitting the introduction of a hydraulic fluid into a sealed space on the opposite side of said piston from said resilient member; and  
whereby hydraulic fluid is introduced into said cylinder to move said piston carrying the continuous hydraulic conduit against an opposing force of said resilient member whereby when pressure of the hydraulic fluid is discontinued, said piston will return to an equilibrium position of said resilient member.

- [c46] A method to connect a hydraulic control line to a continuous hydraulic conduit extraction device comprising:
- connecting a first hydraulic control line to a well valve;
  - connecting a second hydraulic control line to the extraction device;
  - connecting the first and the second hydraulic control lines to a common source of hydraulic pressure;
  - coordinating the pressure from the source to the first and the second hydraulic control lines; and
  - whereby when pressure drops for any reason from the first hydraulic control line, pressure on the extraction device, will be first released to extract the continuous hydraulic conduit from the well valve, and thereby allow safety to close after the extraction of

the continuous hydraulic conduit from below the well valve.

[c47] An apparatus for maintaining a small diameter continuous hydraulic conduit below a wellhead master valve comprising:

- a wellhead spool providing a side entry to a wellhead longitudinal axis for a first continuous hydraulic conduit having a flange at each longitudinal end for attachment within a wellhead assembly;

- a seal assembly connected to said side entry allowing longitudinal movement of the continuous hydraulic conduit;

- a tubing hanger, providing a polished internal bore, inserted in a wellhead profile below a master well valve to retain a second hydraulic conduit in the well bore; and

- a stinger connected to a distal end of the continuous hydraulic conduit to sealingly engage in the polished internal bore of the tubing hanger to allow continuous hydraulic communication through the first hydraulic conduit into the second hydraulic conduit.

[c48] A method for inserting and maintaining small diameter continuous hydraulic conduit comprising:

- shutting in a well;

- removing a master valve;

attaching a side-entry spool on the wellhead;  
inserting a continuous hydraulic conduit through a seal on the side-entry spool;  
opening the well; and  
lowering the continuous hydraulic conduit into the wellbore.

[c49] The method of claim 48 further comprising setting a tubing hanger in a wellhead to hang a second small diameter continuous hydraulic conduit from the tubing hanger to a production zone of the well.